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# OverPlotter: A Utility for Herschel Data Processing

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**Abstract.** The OverPlotter utility is a GUI tool written in Java to support interactive data processing (DP) and analysis for the Herschel Space Observatory within the framework of the Herschel Common Science System (HCSS)(Wieprecht et al 2004). The tool expands upon the capabilities of the TableViewer (Zhang & Schulz 2005), providing now also the means to create additional overlays of several X/Y scatter plots within the same display area. These layers can be scaled and panned, either individually, or together as one graph. Visual comparison of data with different origins and units becomes much easier. The number of available layers is not limited, except by computer memory and performance. Presentation images can be easily created by adding annotations, labeling layers and setting colors. The tool will be very helpful especially in the early phases of Herschel data analysis, when a quick access to contents of data products is important.

## 1. The Herschel DP OverPlotter Package

The OverPlotter (OPL) utility inherits and extends the HCSS TablePlotter (TPL), a component of TableViewer (Zhang & Schulz,2005). OPL is offered as a java plug-in and is available under HCSS DatasetInspector (DI). The data stored in two selected columns of a Table Dataset is plotted as an X/Y scatter plot. An example of the OPL with just one scatter plot is shown in Figure 1. The control panels are similar, but show several additions including the "Layer Panel", a set of synchronization buttons, as well as a "Preferences" button. The fundamentally new feature that OPL provides, is its capability to add more scatter plots of different columns and datasets, which are overlaid on top of the previous plots for comparison and analysis.

### 1.1. Adding Layers

New layers are added in the same way as selecting the data columns for the first plot. If an OPL panel already exists, the new plot is overlaid as a new layer within the same window, after presenting the user with the option to change the default name for this new layer. The new layer becomes the active layer, and the previously active layer is given secondary active status. By default, blue, green, and gray colors designate active, secondary active, and inactive layers respectively. Figure 1 shows active and secondary active layers in blue and green respectively. Within every DI session, only one OPL is allowed. All additional layers will be directed to this one. The OPL can be cleared and reset by creating a new plot layer and naming it "New".

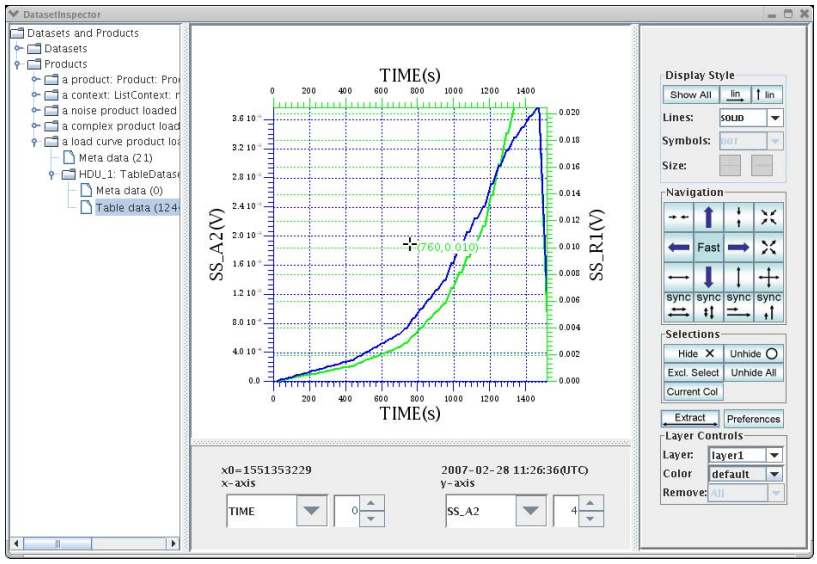


Figure 1. The OverPlotter: The left panel shows datasets and products that can be displayed. The center panel hosts the OverPlotter with graphs of two datasets in blue and green. On the right and bottom are the various panels to provide navigation and selection functions.

## 1.2. Layer Manipulation

A specific layer can be activated using the "Layer" selector in the "Layer Controls" panel. When a layer becomes active, all operations in the control panel will be exclusively applied to this layer. All the other layers remain unchanged. This way a specific plot layer can be shifted and scaled until it matches the other layers in some way. For instance, the shape of a glitch in time ordered detector data can be compared to other glitches appearing at a different time and with a different strength. Two shifted layers relatively to each other are shown in Figure 2.

The "All" position in the "layer selector" activates all layers. In this configuration, all layers are manipulated/navigated in the same way, so the relative scaling and position of the layers are locked with respect to each other. Other selectors change the default colors, or allow to remove individual layers.

## 1.3. Setting Preferences

Another new feature in OPL allows users to set preferences. The OPL is invoked with a set of default factors to control fast and slow zooming and panning. Those factors can be modified, changed, or reset by selecting "set properties" from the pop-up menu. By choosing adequate fast and slow values, the plot in one layer or all layers can be navigated very fast and precisely.

The display of complex data columns is another new feature that is controlled through the preferences menu. The menu provides a choice to either use real part, imaginary part, or the absolute values for the respective axis in the plot.

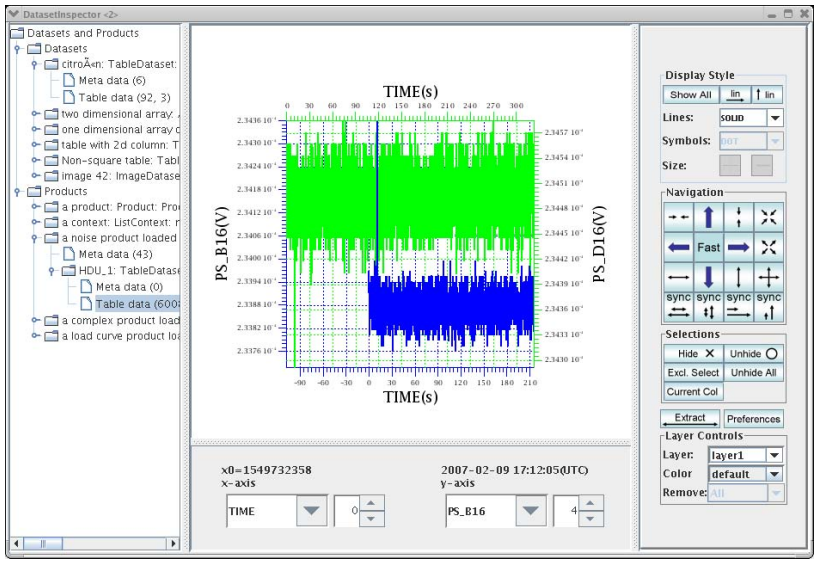


Figure 2. This view of the OverPlotter shows two datasets, of which the primary active layer (blue on bottom) is shifted relatively to the secondary layer (green on top) along the x-axis by about 105 seconds.

### 1.4. Synchronization of Layers

Comparison of two plot layers can become very cumbersome if only the pan and zoom buttons are used and a precise match of scales in x- or y-direction is required.

As an aid we implement synchronization buttons for each axis to synchronize the scale or offset in both active layers, i.e., the primary and secondary active layers. The offset synchronization button shifts the selected axis (x or y) of the primary active layer such that the lowest point is equal to the one in the secondary active layer, while the scale stays the same. The scale synchronization button changes the scale of the primary active layer to become equal to the scale of the secondary active layer, while keeping the offset for the lowest point constant.

### 1.5. Interactive Data Selection and Extraction

Data operations are limited only to selected data. Initially all data are selected. To temporarily remove data from the plot, several selective buttons have been implemented. To conserve a selection of data, the currently selected data can be extracted into a new dataset. This can be very helpful in removing unreliable data points from datasets, or to de-glitch data. The functionalities of the "Hide", "Unhide", "Excl. Select", and "Unhide All" buttons are the same as for the TablePlotter. See Figure 3 for an example of partially de-selected data.

Data extraction is limited to the currently active layer only. Extraction is disabled while all layers are selected. Features like, the selection of columns for extraction, work the same way as in TablePotter.

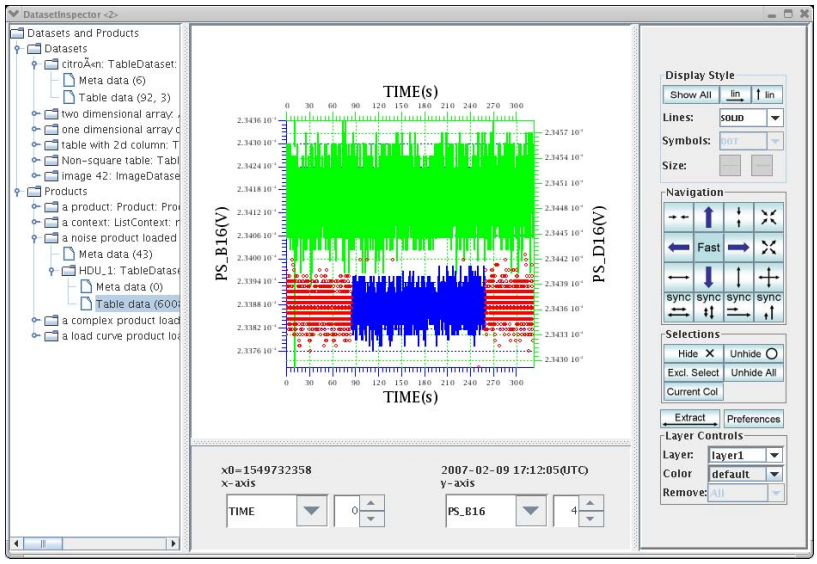


Figure 3. In this example two layers are shown, of which the primary active layer (lower graph) contains a number of de-selected data points on the left and right that are marked with red crosses.

## 2. Limitations and Future Work

The current release is still a prototype and is limited to simple numeric data arranged in columns (including complex data). Development is currently ongoing to produce a first delivery version for the HCSS.

In the future we intend to generalize the applicable data types further to accept table datasets with different data arrangements like rows or columns containing more-dimensional arrays. Direct loading of FITS data from the file system may also be supported in the future.

Since the GUI is available as a JComponent, it should be easy for other GUI environments to adopt the OPL as a plug-in for various applications. It can be easily extended as a standalone application as well.

## References

Wieprecht, E., Brumfit et al., 2004, The HERSCHEL/PACS Common Software System as Data Reduction System, Vol. 314 Astronomical Data Analysis Software and Systems XIII, page 376.

Zhang and Bernhard Schulz, 2005, The TableViewer Utility, Vol. 351 Astronomical Data Analysis Software and Systems XV, page 89.